Slawson's earlier work on carbon recrystallization appears to have been sound (Slawson, 1953). Had the decomposition of the mercury-carbon system, HgC_2, been susceptible to greater experimental control, synthetic diamond might well have resulted.

Typical examples of each class of solvent is given in Fig. 8. The flow diagrams illustrate the case of a simple binary solution (Ni-C), as well as that for a quasi-simple solution (the probable unstable carbides of cobalt, Co_3C, Co_2C, and possibly CoC). Manganese and iron are representative of solvents yielding residually stable carbides.

Pressure-temperature diagrams are given in Figs. 9 and 10 for the nickel-carbon system and the manganese-carbon system, respectively. Both include the Berman and Simon data for the carbon-carbon system. Estimated limits of error are included. Slightly different values have been reported recently by Bundy, *et al.* (1961) for the nickel-carbon system. The difference may be explained on the basis of variation in measurement due to the differential elastic and thermal characteristics of complex reaction cell design. Different materials transmit pressure and heat with different efficiencies. An accurate ability to concurrently measure high pressures and temperatures remains to be developed.

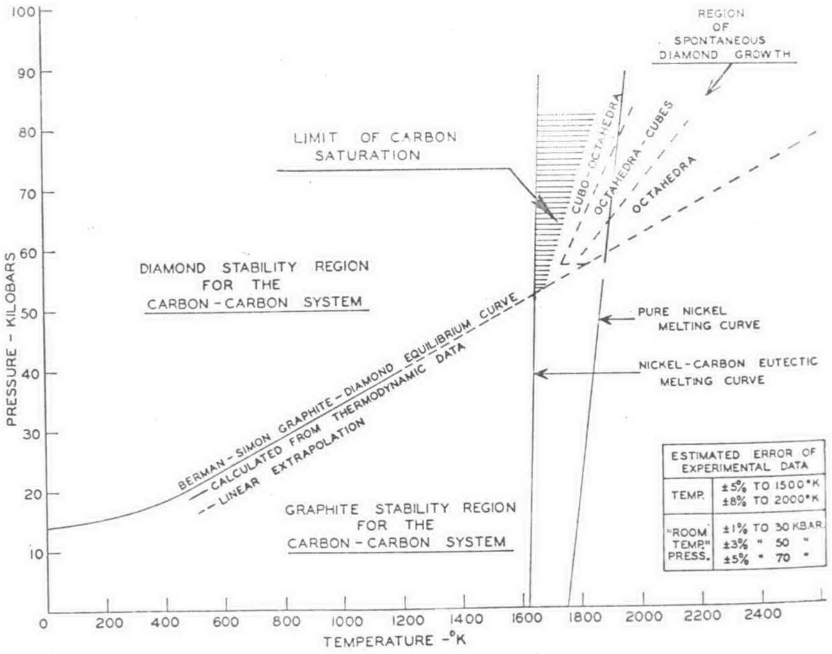

FIG. 9. Composite pressure-temperature diagram for the systems carbon-carbon and nickel-carbon. Pressure values are referred to the bismuth transitions taken at 25.4, 26.9 and 90 kilobars and that for barium at 60 kilobars. Temperature values were determined by thermocouple measurement.

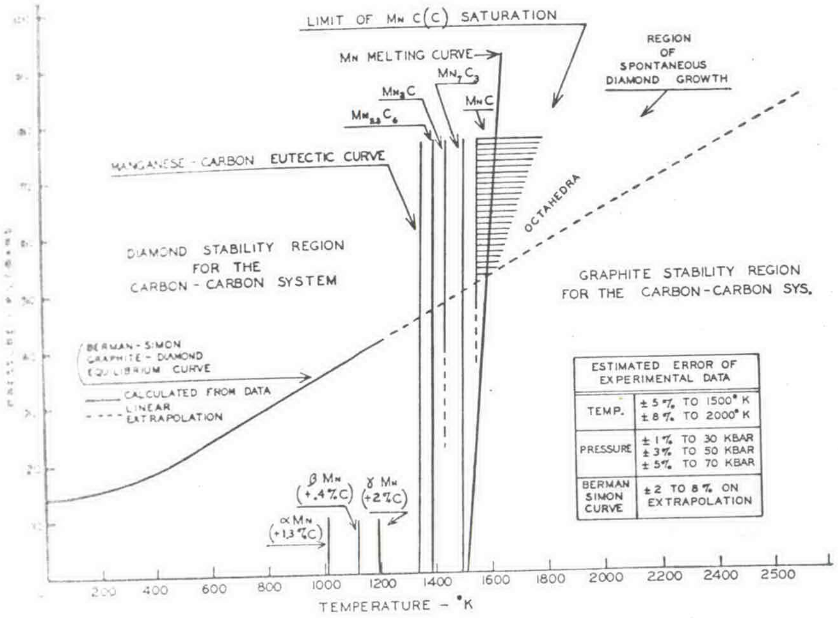

FIG. 10. Composite pressure-temperature diagram for the systems carbon-carbon and manganese-carbon. Pressure values are referred to the bismuth transitions taken at 25.4, 26.9 and 90 kilobars and that for barium at 60 kilobars. Temperature values were determined by thermocouple measurement.

During the course of work on diamond, it has been observed that crystals synthesized from both nickel and cobalt invariably contained an internal contamination of the metal solvent. The degree of contamination (and crystal morphology) was found to be dependent upon the temperature during crystallization. The presence of impurity generally could be readily detected by a visual discoloration in shades of yellow, green or brown. A more quantitative determination can be made either by determining the degree of magnetism, by analytical optical techniques, or x-ray diffraction. Diamond grown from Fe or Mn solutions, on the other hand, could be made colorless and chemically pure.

The fundamental cause for this difference in purity has been gleaned from a study of analytical data obtained from the spectrographic and x-ray diffraction study of the diamond and related products from the various chemical systems. Contamination is directly related to the degree of structural compatibility of phases present during crystallization with